

***UNITED STATES
PATENT AND TRADEMARK OFFICE***

Information Technology Standards and Guidelines Program

ECONOMIC ANALYSIS

IT-212.2-13



**October 1998
Washington, D.C.**

- **Managing AIS Projects as Investments**
- **The Economic Analysis Process**
- **Documenting and Reporting Results of Economic Analysis**
- **Guidance for Developing the Business Case**



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

October 1, 1998

Executive Summary

PTO must manage automated information system (AIS) projects as investments. Proposed AIS projects must be supported by an analysis of costs and benefits associated with leveraging information technology to support business objectives. Mission critical systems and AIS projects with life cycle costs exceeding \$25 million will be supported by an economic analysis. Its purpose is to provide a high level description of performance measures, costs, benefits, and schedule.

The Project Manager develops the business case during the Initiation Phase of the system life cycle and presents the business case to the Technical Review Board as part of the Concept Briefing and Baseline Meeting. In preparing the Economic Analysis, the Project Manager systematically evaluates various alternatives for leveraging information technology to achieve PTO business goals. To accomplish this, the Project Manager, assisted by the System Development Manager, must identify and analyze the expected costs, benefits, and programmatic and technical risks of each alternative.

This Technical Standard and guidelines provides the framework, process and tasks involved in developing the business case and preparing the Economic Analysis. This document is published by the Office of the Chief Information Officer (CIO), Technical Plans and Policy Staff, as part of its Technical Standards and Guidelines for Automated Information Systems Program. The primary users of this publication are Program Sponsors, Project Managers, System Development Managers, their staff, and support contractors for the applicable AIS project. Compliance with provisions of this Technical Standard and Guidelines is required for all AISs designated a mission critical, or having full life cycle costs in excess of \$25 million unless specifically waived by the CIO.

Constructive comments concerning this publication should be forwarded to the Technical Plans and Policy Staff.

Signed _____
Dennis R. Shaw
Chief Information Officer

1 October 1998
Date

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1.0 INTRODUCTION

1.1 Purpose

This Technical Standard and Guideline for Economic Analysis establishes the framework, responsibilities, data requirements and reporting criteria for completing a business case and a more detailed economic analysis of alternatives for leveraging information technology to achieve a business objective(s). The concepts and information set forth in this guideline assist PTO managers responsible for making information technology investment decisions.

This is intended to be a simplified guide providing the basic, minimum requirements that the project manager must address to produce a valid, useful and complete analysis, without consuming an inordinate amount of time or staff resources. A glossary of terms used in this TSG is found in appendix A.

1.2 Managing AIS Projects as Investments

PTO must manage AIS projects as investment. Each AIS project will be supported by a business case. The business case is developed during the Initiation Phase of the system life cycle. Its purpose is to provide a high level description of the business function to be supported, performance measures, costs, benefits, and project schedule. Mission critical systems and proposed AIS projects with system life cycle costs exceeding \$25 million will be clearly supported by a detailed economic analysis. This detailed analysis consists of: the project's expected costs and benefits; alternative solutions considered; potential programmatic and technical risks; the AIS's overall contribution to the business area and PTO's mission, and goals and objectives. This information is documented in an Economic Analysis during the Concept Phase of the system life cycle.

1.3 Background

Before undertaking the development or deployment of new or upgraded automated information systems (AISs), the Patent and Trademark Office (PTO) must ensure that the project is a worthy investment, in terms of whether or not the system is likely to improve the quality and value of the agency's business performance. In order to make this determination, specific policies, procedures, and practices governing the management of AISs have been established by the Office of the Chief Information Officer, and are contained in the Life Cycle

Management (LCM) for Automated Information Systems Manual¹. The LCM process begins with the identification of a business need that can be satisfied by automation.

To assist PTO managers in assessing the business value of proposed information technology projects, the Project Manager, with the assistance of the System Development Manager, identifies, and systematically evaluates various alternatives to achieving PTO business goals. The proposed project must be clearly supported by detailed analyses of the project's expected costs and benefits, alternative solutions considered, potential programmatic and technical risks, and overall contribution to the PTO and business area mission, goals, and objectives. This systematic process is known as an Economic Analysis.

Support for the conduct of economic analysis as a standard business management activity is further strengthened by The Clinger-Cohen Act of 1996, which mandates that executive agencies develop and institute an Information Technology Capital Planning and Investment Process. This process requires that information technology investments be linked to strategic goals and business plans that enable senior managers to make informed decisions based on the value, risks and benefits of proposed projects. In conjunction with other sources of information, economic analyses provide needed information critical to PTO's Capital Planning and Investment Process. Figure 1-1 depicts the phases of LCM as they relate to an economic analysis².

Economic Analysis Within the Context of LCM

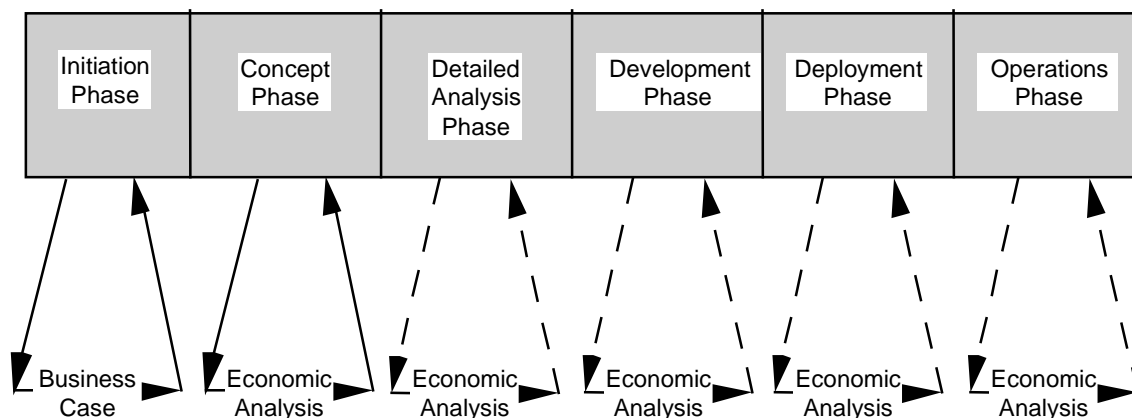


Figure 1-1

¹ A copy of the LCM-AIS Manual (December 1997 issue) may be obtained from the Technical Library located on the OCIO Home Page at <http://cioweb/cio>.

² Through the remainder of the system life cycle, the economic analysis is to be updated if major changes in costs, risks, or uncertainties occur.

1.4 Assessing the Information Technology Investment

1.4.1 Information Technology Strategic Planning

As part of the PTO's corporate strategic planning process, decisions are made as to how best to leverage information technology in support of key PTO mission objectives as well as business area specific goals and commitments. To this end, the Chief Information Officer annually prepares and issues the PTO's Strategic Information Technology Plan as an appendix to the PTO's Corporate Plan. All AIS projects are to be included in the Strategic Information Technology Plan, mapped to specific PTO and business area goals and objectives, and must contain a statement of the expected business benefits to be realized and performance measures used to assess results. This allows AIS project resources to be identified and allocated as part of the corporate strategic information technology planning cycle.

1.4.2 Developing the Business Case

Each potential AIS project is evaluated in the context of how it can improve or enhance a PTO business process or operation. During the LCM Initiation Phase, the Program Sponsor identifies and documents the business case for the AIS and the business benefits, which can be expected by its development or deployment. The business case provides brief, high level descriptions of:

- A. the PTO business process, function, or need that can be improved or enhanced through application of information technology,
- B. an initial description of how the AIS project will address this need,
- C. a preliminary range of schedule and funding estimates,
- D. any known budget, regulatory, security or legal constraints specific to the business process, and
- E. any other known process improvement activities that may be impacted by the AIS.

Appendix A provides specific guidance on the basic elements to be included when developing a business case, and includes examples of the type of information found within each element. Information within each element should be brief and concise. Each AIS project must be supported by a business case.

1.4.3 Other Preceding Activities and Documentation

Once the Program Sponsor successfully makes the business case, formal documentation is developed which is signed by the Program Sponsor and CIO affirming that resources and staff are committed. This document is the Statement of Need. Other documents such as Executive Council decision memorandums may be substituted for the Statement of Need. Once the Program Sponsor and the CIO agree, the project is then authorized to move to the Concept Phase where considerations are made regarding the context through which the AIS project addresses the business requirements. Other important decisions regarding high-level architecture, assumptions, and constraints, cost and schedule requirements, and performance measures/critical success factors, are also made in the Concept Phase. All of these considerations are documented in the System Boundary Document for the AIS. From the system boundary requirements, feasible alternatives to achieving the business objective(s) can be identified and explored by completing the Economic Analysis.

Figure 1-2 depicts the hierarchy of the LCM Initiation and Concept Phases as they relate to the economic analysis.

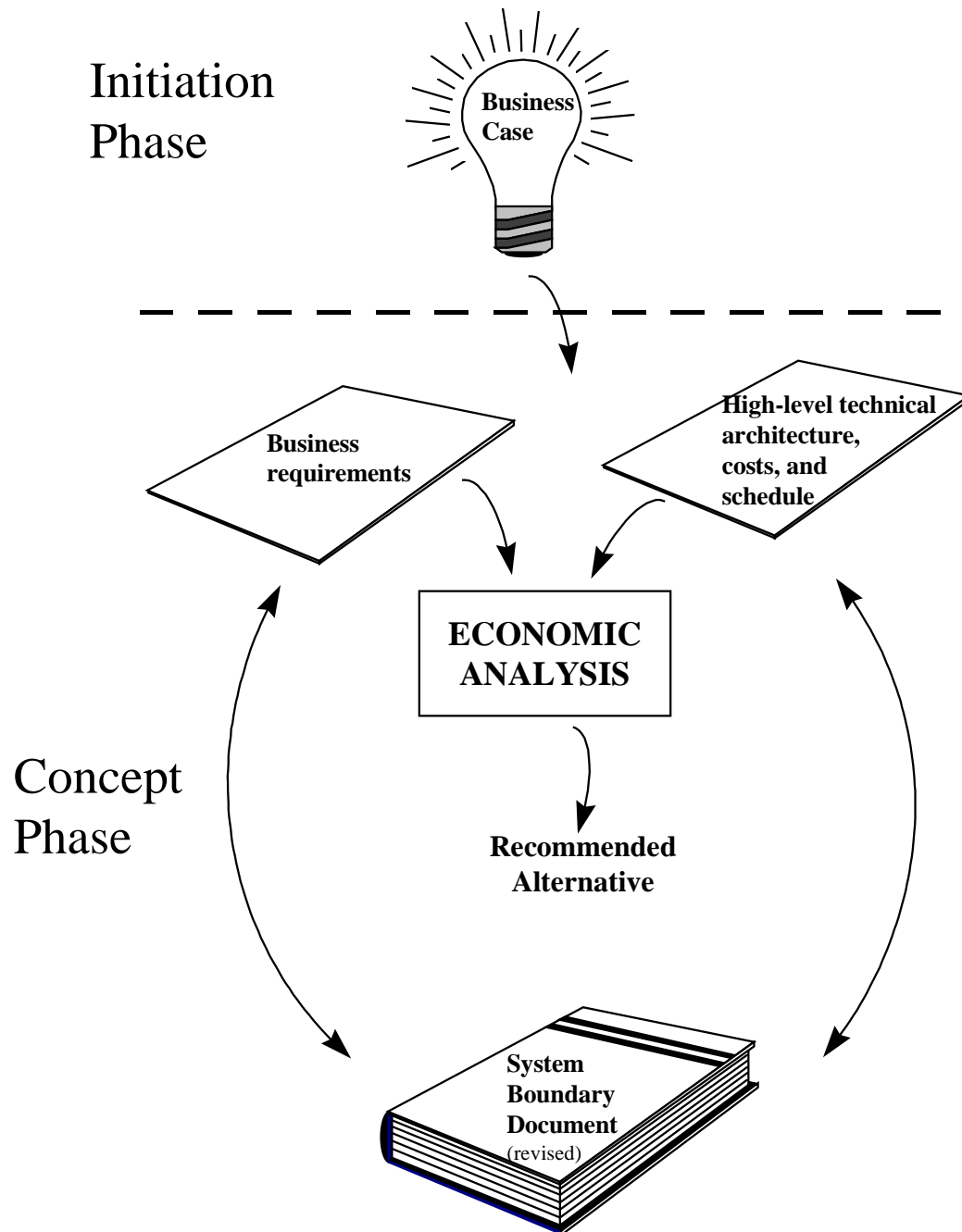


Figure 1-2

The System Boundary Document, like the economic analysis, is a living document that must be revised should significant changes in business requirements, assumptions, cost, or schedule occur.

1.4.4 Economic Analysis Tasks

Economic analysis is a systematic approach to examining the cost and benefits of feasible alternatives for achieving a given business objective(s). It provides critical information that is considered by PTO managers, along with other factors, as input into deciding the best alternative. PTO's investment in information technology must be considered within the context of an entire portfolio of projects. Senior PTO managers must assess the business worth of an AIS project in terms of changing needs of the business and advances or changes in technology or services.

Performing the analysis is a collaborative effort among business area and information technology specialists, managed by the project manager. In order to effectively manage this effort, the project manager must:

- identify and document all assumptions and constraints that will be applied in determining the pool of feasible alternatives to be investigated,
- investigate feasible solutions to achieving the business objective. Feasibility determinations are based on economic, technical, and operational considerations,
- identify the investment and operations costs and benefits of all feasible alternatives,
- test the sensitivity of the outcome of the analysis to major uncertainties, and
- compare alternatives and recommend the alternative offering the best value to satisfying business objective(s).

2.0 THE PROCESS

2.1 Tailor the Economic Analysis

In order to be valid and complete, the economic analysis process must be systematic, consistent, and capable of being replicated by others. AIS projects vary in scope from simple to complex. The level of effort and expenditure of resources that go into the conduct of the analysis should correspond to the depth, scope and impact on the business area or PTO's mission if the proposed solution is implemented.

The project manager has some latitude in tailoring tasks, steps, and interim products to fit the unique aspects of the project and the overall value of the investment to the PTO. For example, an information technology infrastructure project that involves the installation of new or replacement hardware or system software products, upgrading an existing operating system, would be subject to different tailoring decisions than a new AIS development project, intended to support a new or changed business function. An infrastructure upgrade project might not need a full explanation of the current system. Instead, the project might concentrate on a workload analysis. The reverse might be true for a new AIS.

Another consideration driving tailoring decisions is cost-effectiveness. For example, it would not be cost-effective to spend \$50,000 for an economic analysis to investigate alternative solutions when the effort would yield a maximum benefit to the PTO of \$500,000. Common sense should prevail.

Any tailoring that occurs should be consistent with the established objectives of the analysis and be fully documented. The project manager should refer to the AIS Development Plan and Process Tailoring TSG IT-212.2-033 for specific guidance.

2.2 Identify Assumptions and Constraints

During the development of the business case and the system boundary decision making process, the purpose of the AIS and objective(s) of the economic analysis have been established, along with major assumptions and constraints concerning the business environment and system architecture for the proposed AIS.

³ A copy of the AIS Development Plan Process and Tailoring TSG IT-212.2-03 may be obtained from the Technical Library located on the OCIO Home Page at <http://cioweb/cio>.

Assumptions are explicit statements of conditions on which the economic analysis is based. There will be assumptions related to the business area functions, e.g., estimated future workload, or reengineering decisions, as well as cost-related assumptions such as the system life cycle.

Constraints are factors external to the business environment that can further impact on or limit alternative solutions to meeting the business need. These constraints are often beyond the control or influence of the project manager. They can come in many forms, e.g., physical, as in a fixed amount of space; time-related, as in fixed deadlines; or regulatory, as in the case of rule making.

Assumptions and constraints should be established and fully documented early in the process in order to prevent the recommendation of an alternative that becomes operationally unfeasible, or cannot be implemented due to factors not within the project manager's control. Appendix F provides examples of assumptions and constraints.

2.2.1 Technical Reference Model

Feasible alternatives are constrained by the requirement that they must conform to the PTO Technical Reference Model (TRM). The TRM defines a comprehensive set of information technology standards, services, interfaces, supporting data formats, protocols and products that define the target technical environment for the acquisition, development, and operation of all PTO AISs. Any departure from these requirements must clearly show that the benefits of using a non-TRM compliant product would offset the increased information technology infrastructure operations and maintenance costs over the life of the system.

2.2.2 Information Technology Infrastructure

The project manager should keep in mind that an AIS project's computer and network resource requirements must be satisfied by PTO's current or planned information technology infrastructure. In preparing the economic analysis, the project manager must consider capacity increases to the existing information technology infrastructure, such as processor upgrades, additional storage, new or additional COTS software licenses that will be needed, or additional information technology components, such as workflow servers or workstations. The Systems Architect and the system development manager will assist the project manager in estimating information technology infrastructure costs.

2.3 Determine Alternatives

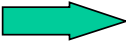
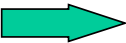
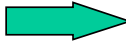
Often, there is more than one way to achieve a given business objective. Since it would be impractical to attempt to analyze every possible option, the analysis should consider all reasonable alternatives. There must be at least two feasible

alternatives considered in the analysis – the current system and a proposed alternative. The current system serves as a baseline with which to compare new alternatives, so measurement of both the cost and benefits of the current (baseline) system should be done along with those of the alternative(s).

Each alternative should meet pre-determined minimum requirements in order to be included in the evaluation of alternatives. Determinations may be made based on unique characteristics of the business area such as:

- daily workload volume
- method of operation (e.g., direct customer contact, manual versus automated document transfer)
- day-to-day activities (e.g., customer service hours)
- type of equipment (e.g., personal computers, bar-code readers)
- compatibility with PTO's information technology infrastructure (See Section 2.2.1)
- unique environmental conditions (e.g., need for controlled access, special temperature control, etc.)

Figure 2-3 depicts how pre-determined criteria may be applied to potential alternatives as part of the screening process. Use of a chart such as this enables quick documentation of why certain alternatives were included in the analysis, while also showing that others were considered, but not included, and why. The number of alternatives and criteria shown are for illustrative purposes only.

ALTERNATIVE(s)	CRITERIA			
	Processes 500 Records Daily	24-Hour Dial-up Remote Access	Expansion to 2,000 Users	Direct Customer Contact
 1 (current)		✓	✓	✓
 2	✓	✓	✓	✓
3	✓	✓		
4			✓	✓
 5	✓	✓	✓	

SCREENING ALTERNATIVES

Figure 2-3

2.4 Determine System Life

All resources required to meet the stated business objective(s) must be shown in the analysis. In order to realistically accomplish these business objectives, a decision must be made regarding the time frame or system life over which each alternative will be compared. In most cases, the system life is the period of time from project inception through system replacement or retirement. The proposed system is expected to yield a service or benefit during the operational phase.

The following will be helpful in setting the system life that will govern the time period covered by the economic analysis.

- To the maximum extent possible, the system life remains constant throughout the analysis and is used for all alternatives.
- The same base year should be used for all alternatives, i.e., the first year in which expenditures will be made for any one of the alternatives should be considered the base year for all alternatives. For example, if Alternative A requires investment costs for three years before it is deemed operational, while Alternative B requires two years before it is

operational, the base year for Alternative A is used for both. However, Alternative B will have no investment costs for the third year.

- Whenever possible, the time period should be set so that all alternatives yield benefits for the same period of time.

The system development manager will assist the project manager in determining the system life of the proposed AIS.

2.5 Estimate and Analyze Costs

Life cycle cost estimates of each alternative must include all costs. Life-cycle costs are all costs associated with the AIS project from inception through system replacement or retirement. Estimates should be made by the year the cost is to be incurred. To simplify this process, costs may be separated into two categories - investment and operations.

- Investment costs are those made on a one-time basis. Although investment costs occur one-time, they can be spread out over several years as long as each year is identified. Typically, investment costs include all costs associated with design, development, and deployment of an AIS.
- Operations costs are those recurring costs associated with maintaining the AIS in a production environment. Operations costs include hardware maintenance, application software maintenance and modification, COTS software license fees, information technology support services, and operations personnel costs.

Appendix C provides examples of investment and operations cost elements. Appendix D is a completed sample cost spreadsheet, using both investment and operations cost elements, laid out by year incurred.

2.5.1 Sunk Costs

Sunk costs are those costs that have already been incurred. Sunk costs should be identified but not included as part of the cost analysis. This is because sunk costs have no impact on future spending decisions.

2.5.2 Treatment of Inflation

Economic analyses involve trade-offs that are time-phased. Therefore, in most cases, estimates for inflation must be considered in order to select the alternative with the lowest life cycle cost. A rule to remember, however, is that due to the

uncertainty of forecasting future economic conditions, particular care should be given when extending inflation calculations beyond four years.

For each year in the life cycle, cost estimates will first be made in terms of present or base year (constant) dollars. When inflation is considered to be important to the analysis, a second computation will be made in terms of current (with inflation) dollars. Using the constant dollar estimates as a baseline, compute cost and benefits using current dollars. Contact the PTO Office of Budget to determine the appropriate inflation rate, which should be documented in the analysis.

2.6 Analyze Benefits

Benefits are the outcomes expected from deploying an alternative. Benefits can be improved effectiveness, service, productivity, or performance. They can also be in the form of reduced costs.

As with costs, benefit analysis must be driven by the relative complexity, size, and scope of the problem. However, in general, the following three-step approach can be taken:

- (1) Determine, list, and define all relevant benefits of each alternative.
- (2) Identify sources of information and collect the data, being concerned not to overlook data already existing. Do not duplicate work.
- (3) Determine the most useful and accurate measurement scheme.

To the maximum extent possible, all benefits should be quantified and included as relevant information for the decision-maker. Some benefits are intangible in nature. Intangible benefits must be identified and included in the economic analysis.

2.6.1 Determine, List and Define Relevant Benefits

This step involves determining and describing the benefits for each alternative.

During the strategic planning and business case decision making processes, benefits to be realized by the business area or PTO customer with the development and deployment of the AIS were identified. In order to be meaningful, benefits should be linked to costs incurred for that alternative. The nature of the organization or business goals to be achieved will often shape the identification and measurement of benefits. Appendix E provides examples of specific benefit elements and the type of narrative that should be provided when defining benefits of feasible alternatives.

2.6.2 Identify, Collect, and Evaluate Information

The Project Manager establishes data sources for each benefit, determining in what form it is available, and how it can be collected. Sources to be considered include established reports, surveys, documented observations and expert opinions, and written procedures or steps for a work process. Project Managers should to avoid generating unnecessary work or duplicating data existing elsewhere or in another form. For example, if a reduction in search transaction time is established as a benefit, one source would be the Information Systems Executive Report, issued monthly by the Office of the Chief Information Officer. A copy of these monthly reports can be obtained from the PTO Shared Folders, in CIO News/Miscellaneous Information.

2.6.3 Determine Measurements

The third step is to devise the means for measuring benefits of each alternative. The project manager must be innovative and flexible when devising a system to measure the benefits of each alternative. However, the following are some examples of quantifiable and intangible benefit measures.

(1) Quantifiable Benefit Measures

- (a) Direct Dollar Value. Some PTO benefits are quantifiable with a direct dollar value. For example, the output of some PTO information technology solutions or a new automated information system can be increased savings due to reduction in needed overtime to correct filing fees. Appendix E provides an example of this measure.

Where there are common measures among all alternatives (e.g., pages per hour, orders per day, lead-time per day) a dollar-valued quantitative basis for

comparison is made easier. Where there is a mixture of measures, or a direct dollar value cannot be easily linked to the expected benefit, another method is to devise a weighting scheme that assigns “points” to each type of benefit. For example, the project manager can select a number of benefit elements such as, improved efficiency, increased accuracy, and increased reliability, determining the relative importance of each. The relative importance of each of these benefits can be expressed as a weighted factor, from within a defined range (e.g., 1 through 10). This summary statistic can then be used as the basis for comparison. If used, this weighting scale should be devised before actual measurements begin in order to ensure an unbiased outcome. Figure 2-4 shows an example of a weighting scheme. Number of benefit elements and points assigned are for illustrative purposes only.

EXAMPLE WEIGHTING SCHEME

BENEFIT(S)	ALTERNATIVES		
	A	B	C
increased reliability	9	9	9
increased accuracy	7	7	
increased productivity	5		
improved efficiency	3	3	3
Summary Statistic	24	19	17

<u>Benefit Element</u>	<u>Points</u>
increased reliability	9
increased accuracy	7
increased productivity	5
improved efficiency	3

Figure 2-4

- (b) Imputed Dollar Value. In some cases, it may be possible to impute a dollar value by finding a comparable system in either the public or private sector that does have a direct dollar-valued output, such as the Internal Revenue Service’s electronic tax return filing system, which may be comparable to the PTO’s electronic application filing system. Industry best practices benchmarks are also available that can be used to help identify and quantify costs and benefits. The best practices benchmarks cover common business areas such as human resources, finance, and office automation. Once a comparable system has been located, estimates of the dollar value changes in revenue or reduced costs resulting from the same (or closely similar) alternative may be imputed. Locating a comparable system and the necessary data to accomplish this is often difficult, and should only be undertaken if the effort involved is justified by the potential trade-off in dollar value for

that alternative. Industry analysis organizations, such as the Gartner Group, maintain best practices benchmark data.

- (c) Value of Saved Resources. Estimating the value of certain benefits by looking at the cost of resources saved (e.g., reduced downtime, or non-productive time) by implementing the new AIS is another acceptable way of measuring benefits. When selecting this method, the importance of having included the current system as the baseline is most evident. However, when estimating cost of saved resources as a benefit of the current system, the assumption is that the current system is of itself, cost-justified. If this assumption is valid, it reduces the remainder of the work involved because only the *net additional benefit* (saved resources) realized as a result of the new AIS needs to be shown as compared to the additional cost of implementing the new AIS. Appendix B provides an example of this method.
- (d) Reduced Costs. In some cases, the reduction in operating cost is the primary benefit. This is especially true in information technology projects such as acquiring PTO-wide site licensees, providing a common office automation suite of products, and implementing automated operation software.

Whatever method or measuring scheme is chosen to quantify benefits, it is important to remember that all assumptions, procedures, and techniques should be fully documented. Also, project manager's must keep in mind that elimination of all subjectivity is unlikely, and that any weaknesses in the measurement scheme should become evident upon completion of the sensitivity analysis discussed in Section 2.8.

(2) Intangible Benefit Measures

Despite best efforts to develop quantitative measures of benefits, often PTO organizations will be faced with measures that just do not lend themselves to quantitative comparison. Certain projects may provide only intangible benefits such as improved employee morale, better Trilateral cooperation or other improved customer relations, and other similar qualitative advantages. Making the patent and trademark data available on the Internet for the public to search is an example of improved customer relations. Qualitative comparison of benefits is more difficult to assess and, due to the lack of precision, is less preferable. However, it is an option available when the project manager determines that the benefits of an alternative are simply not quantifiable. When this method is selected, observing the following guidelines should help to make qualitative comparisons more meaningful and consistent.

- (a) Identify all benefits for each alternative under consideration. Give complete details in precise terms.
- (b) Identify benefits common in kind but not in extent or degree among alternatives. Explain differences in detail. Figure 2-5 shows one way of laying out qualitative benefits of an alternative when the impact of the benefit is not equal in extent or degree.
- (c) Avoid platitudes. They only serve to cloud the decision-making process.

BENEFITS	ALTERNATIVES		
	1	2	3
1	◐	◐	●
2	○	●	○
3	●	○	●
4	○	◐	◐
5	○	○	◐
6	◐	○	●
7	●	●	●

COMPARISON OF QUALITATIVE BENEFITS

Figure 2-5

Appendix E provides examples of quantifiable, as well as intangible, benefits.

2.7 Summarize and Compare Alternatives

Once costs and benefits for all alternatives have been determined, an evaluation of one against another is made to determine the one offering the best value to the PTO. Comparison of alternatives will be made using the Net Present Value (NPV) technique, which is further explained in Section 2.7.1. However, there are a number of additional techniques that may be used if the project manager determines that these techniques add value to the analysis.

- Uniform Annual Cost should be calculated for alternatives with unequal system lives. The most simplistic approach to this would be to base the economic analysis on the system life of the alternative with the shorter time period.
- Savings/Investment Ratio shows the relationship between future cost savings (or avoidance) and the investment cost necessary to bring about those savings. Because savings is a necessary ingredient, this technique can be used only when there is a current or baseline system alternative.
- Break-even Analysis focuses on finding the value of the break-even point. This is the point at which the project manager determines that benefits accrued equal cost incurred.
- Cost/Benefit Ratio shows the relationship between cost (input) and benefit (output). This technique is used to assess alternatives having unequal costs and unequal benefits.

2.7.1 Net Present Value

Net Present Value is determined by first calculating the discounted present value of all cost and benefits and then adding them up. Discounting takes into account the fact that the present value of the dollar declines the farther in the future that it is either received or paid. Guidance on discounting is provided in OMB Circular A-94⁴, and there are a number of standard present value tables commercially available for ease in computing the present value of costs and benefits. TPPS staff will assist the project manager in determining the most appropriate discount rate.

⁴ A copy of OMB Circular A-94 may be obtained from the White House Web Site at <http://www1.whitehouse.gov>

Net Present Value is normally used in economic analyses where the system life is more than three years. Since most PTO AIS projects will have a system life of between five and ten years, present value should be used.

2.7.2 Ranking Alternatives

After the net present value has been determined for each alternative, they may be ranked within one of three major groupings in order to further breakdown the results of the analysis for the decision-maker.

- (1) Least Cost Alternative - All feasible alternatives have the same level of benefits. The alternative with the lowest discounted cost is preferred.
- (2) Maximum Benefit Alternative - Where outcomes are the determining factor, the feasible alternative yielding the greatest benefits for the discounted cost is preferred. Where alternatives did not lend themselves to benefit quantification, the precision, detail and completeness of qualitative narratives become extremely important.
- (3) Unequal Costs/Unequal Benefits - An alternative may be judged preferable if, although costs are greater, they are balanced by greater benefits. In order to simplify this method, feasible alternatives may be ranked in order by lowest to highest NPV. The alternative with the highest NPV would be preferred, provided the greater cost outlay can be justified by funding limitations.

Examples are provided in Appendix G.

2.8 Conduct Sensitivity Analysis

Since economic analysis involves some prediction of future events, elements of uncertainty involved in an economic analysis must be carefully examined to determine their effects and influence on the ultimate analysis recommendations. This is done by evaluating those factors having key relationships with the results of the analysis and by exploring the extent and magnitude of the impact. This evaluation is commonly referred to as sensitivity analysis.

In performing a sensitivity analysis, an investigation is conducted to determine how the results of the analysis may change with respect to changes in parameters or basic assumptions that were made at the beginning of the effort. These parameters or basic assumptions may involve organizational, time, cost, and technical performance issues. If a change in a parameter or an assumption results in a proportionately greater change in results, then the study results are sensitive to that parameter or assumption. Suggested steps are:

- (1) Choose several costs and benefits that appear to have the greatest impact on the results of the analysis and which are most subject to estimation variances.
- (2) Vary each one over a reasonable set of values while holding the other variables in the analysis constant. The reasonable set of values can usually be determined by varying the assumptions underlying the analysis.
- (3) Determine the impact of these changes on the net present value results and the ranking of alternatives.

If the ranking changes, especially with relatively small changes in assumptions, then the decision-maker may want to postpone or change the choice, depending upon the probability of these future events occurring. Appendix G provides an example of such an analysis.

3.0 Reporting and Documentation

3.1 Reporting Requirements

Unclear or incomplete presentation of the rationale, process and findings of the analysis can cause much of the effort to be lost and potentially could result in the project manager making a less preferable recommendation, or implementing a recommendation that cannot be supported. Appendix F provides the template for the content of the Economic Analysis. Appendix G provides examples for each section of the Economic Analysis. Throughout this TSG, emphasis has been placed on the need to fully and completely detail and document all assumptions, steps and procedures used in the analysis. At minimum, the following additional rules should be kept in mind when reporting the results of the economic analysis.

- (1) Identify the principal stakeholders who were involved in the conduct and presentation of the analysis.
- (2) Tables, charts, graphs, mathematical models, and other visual aids can be designed to replace lengthy textual explanations and to emphasize the most significant facts and relationships. Such materials should be included when they assist in the presentation of the analysis.
- (3) Documentation supporting the results of the analysis should include the computations used to derive total cost and output estimates. These estimates should be described in detail.
- (4) Include brief explanations of the source for cost and benefit estimates.

3.2 Documentation and Presentation Requirements

The final look of the economic analysis often depends on the size, scope, and uniqueness of the effort and whether tailoring techniques were used. Appendix F is the table of contents for the Economic Analysis Report. Appendix G is the format and content for the report and provides examples of the type of information to be found within each section. The completed report should be submitted to the program sponsor and the Chief Information Officer.

APPENDIX A

GLOSSARY

Current Dollars: Costs computed with an inflation rate applied.

Discounting: The process of converting future dollars into their equivalent present value, reflecting the time value of money. The discount rate is 10%.

Intangible Benefit: A benefit that does not lend itself to direct dollar computation. However, the benefit is qualitative in nature and is described in precise terms.

Investment Cost: One-time cost associated with the design, development, and deployment of an AIS.

Life Cycle Cost: All costs associated with the automated information system project from inception through system replacement or retirement.

Net Present Value (NPV): Technique for determining the present worth of future costs. NPV is the difference between the discounted present value of benefits and the discounted present value of costs.

Operations Cost: Recurring cost associated with maintaining the automated information system in a production environment. Operations costs include hardware maintenance, application software maintenance and modification, COTS license fees, information technology support services, and operating personnel cost.

Quantifiable Benefit: A benefit of the current system or proposed alternative that can be computed with a direct dollar value applied.

Sensitivity Analysis: An evaluation conducted to determine if the results of the economic analysis changes due to a change in a basic assumption or parameter on which the analysis was based.

Sunk Cost: A cost that has already been incurred. Sunk costs are identifiable, but not included in the economic analysis, as they have no impact on future spending decisions.

System Life: Period of time from project inception through system replacement or retirement.

APPENDIX B

GUIDANCE **for Development of a** **Business Case**

The following provides the basic elements of a Business Case, along with appropriate explanation where necessary. Annotations in smaller typeface provide an example of the type of information found within these elements.

Title of Project

Patent Cooperation Treaty Operations and Workflow Electronic Review (POWER)

Description

-- Provide a high level description of what business function is being performed (which will tie to the PTO mission)

The Office of Patent Cooperation Treaty (PCT) Operations assists US applicants in securing foreign patent rights, acts as a receiving Office for international applications, serves as an International Searching and Preliminary Examining Authority, and processes international applications that are entering US national stage. PCT Operations has been facing a 10-to-15 percent yearly increase in its caseload. Staff resources have not been increased at the same rate. The ability of the existing staff and the current processing stream to meet treaty obligations and provide a high level of service to applicants is being taxed to the breaking point.

-- Provide a high level description, in business terms, of why this information technology project is being undertaken; address business process reengineering efforts as appropriate

The current business process contains certain inefficiencies and redundancies. Steps are currently underway to institute process improvements. While implementation of the improved process will provide some increased processing capability - by itself, it cannot guarantee that workloads can be adequately processed into the future. PCT Operations still faces an increasing physical volume of paper that compounds the problem. Any additional gains in processing capacity and relief from the overwhelming paper must rely on the introduction of automation.

-- Provide a high level description of what is to be done

Imaging technology, paper documents rendered into electronic images and electronic filing, are the first steps to minimizing the volume of paper. Using workflow, document management, and electronic forms software, nearly all of the processing of the PCT application can be accomplished without the movement of paper through the processing stream. Electronic case files will provide information in a media that facilitates exchange with PCT Operations' principal internal customer, the Patent Examiner Corps as well as with the World Intellectual Property Organization (WIPO), Trilateral, and the international partners of the Patent and Trademark Office (PTO).

-- Describe efforts to re-use what has already been done by other projects; describe other systems from which this system gets information or to which this system provides information

Automation of PCT Operations will be building on previous accomplishments in several pilot efforts, specifically Patent Image Capture System (PICS), Patent Reengineering Prototype (PREP), and Reexamination Processing System (REPS). It will be taking elements of each of these efforts to begin building an electronic office within PTO. The automated PCT system also will interface with other PTO systems, such as Patent Application Location & Monitoring (PALM) for monitoring and tracking applications, Patent Application Capture & Entry (PACE II) for entry of bibliographic information into PALM, Certification/Order Entry Management System (OEMS) for requests for US priority documents, the License and Review System for applications requiring L&R review, and Examiner Toolkit to support searches and preliminary examination of PCT applications.

Commitments, Benefits, and Performance Measures

-- Identify the PTO Corporate Plan macro performance goal or goals that are supported; the following was taken from the Corporate Plan Submission to the President dated March 4, 1998

PCT Automation supports the Patents macro performance goal of granting exclusive rights, for limited times, to inventors for their discoveries.

-- Describe the PTO Corporate Plan key commitment or commitments needed to accomplish the macro goal; the following was taken from the Corporate Plan Submission to the President dated March 4, 1998

PTO made a key commitment toward accomplishing this macro goal -- there will be a 12-month cycle time for all inventions in 2003. To meet this key commitment, PTO needs to achieve electronic processing of patent applications in 2003. One of the steps necessary to realize this commitment is the automation of the PCT organization for receipt and processing of electronic applications during 2000.

-- Describe the benefits to be realized by the customer and the staff; if the project is just starting, benefits might not be as detailed as a project with an approved System Boundary document

In addition to meeting a key customer commitment, PCT Automation will provide benefits to customers and staff alike through--

- Efficient Processing: With the introduction of automated PCT processing, application files will be rendered into an electronic form that will be routed through the processing stream that is in compliance with the governing rules and regulations. Editing and error checking will be built into the process reducing the incidence of error and increasing the quality of the work produced. More efficient processing and higher quality product provides the means to a reduction in operational costs.
- Greater Accountability: Tracking of the status of a given application will be improved with the advent of workflow automation. The PCT system will collect tracking and status information providing managers the information necessary to most effectively direct staff effort and control pendency. Applicant queries on application status and other case specific queries will be answered more quickly.
- Increased Compatibility with WIPO: PCT Automation would allow PTO to send to and receive from other PCT offices applications and other related documents in an electronic form. This medium will result in both cost and time savings.
- Improved Work Environment: The physical surroundings that PCT staff works in will be improved as stacks of papers are eliminated from desks and floors. The space currently occupied by paper could be returned to staff. The work area would be cleaner, less cluttered/more open, and generally more esthetically pleasing.

-- Identify the performance measures used to track the success of the project; categories of measures contained in the Corporate Plan Submission to the President dated March 4, 1998 are:

Patents

Effectiveness, Customer Satisfaction, Employee Satisfaction, Productivity, Efficiency, Quantity, and Quality of Output

Trademarks

Effectiveness, Productivity, Efficiency, Quality of Output, Customer Satisfaction, and Employee Satisfaction

Information Dissemination

Quality, Efficiency, Effectiveness, Customer Satisfaction, and Employee Satisfaction

Example 1 illustrates the measures of a system with an approved system boundary; Example 2 illustrates the measures of a system that is just beginning

EXAMPLE 1 – The success of the PCT Automation effort will be tracked using the following performance measurements:

- Reduce time for forwarding record copies to the International Bureau from the current average of 40 days to within 25 calendar days of receiving a complete application.
- Reduce the time required to complete processing of demands from current 50 days to within 14 days.
- Forward substitute sheets to the International Bureau within 30 days from the current 40 days.
- Reduce percentage of PCT applications for which the International Bureau generates a Form IB/313 from current level of 6 percent to no more than 3 percent.
- Speed posting of PCT fees to the Revenue and Account Monitoring (RAM) system from existing 10 days to within 48 hours of receipt.
- Increase the percentage of electronic information exchange from 10 percent to 80 percent.

EXAMPLE 2 – TRADEUPS is one of several new initiatives/systems that, taken together, directly relate to improving these particular Trademark Business Area measures.

- Reduce Time to mail filing notices to 14 days.
- Examine new applications and provide a written communication regarding registerability within three months of the filing date.
- Determine the registerability of trademarks within 13 months of receipt of the application.

Project Schedule and Cost

-- Describe the estimated project schedule; include assumptions, as appropriate

The estimated project schedule is:

<u>Tasks/Products</u>	<u>Estimated Date</u>
Begin project	February 1997
Approve scope & objectives and formalize project (system boundary)	9 months from start of the project
Complete development of the system	12 months from approval and funding
Complete PCT pilot	6 months from completion of development
Complete deployment of automated system within PCT Operations	6 months from completion of pilot
Receive and process PCT applications electronically	FY 2000

-- Describe the estimated range of hardware, software, and services costs expected during the life of the project, and the estimated PTO FTE required; as appropriate, list major components of cost elements.

The cost of hardware, software, and contractor support to prototype, develop, pilot, and implement PCT Automation is estimated to be within the range of \$4.6 to \$5.7 million. A more definitive budget will be developed as part of the project management plan.

<u>Element</u>		<u>Low Est.</u>	<u>High Est.</u>
Hardware		2,033,000	2,750,000
Servers	550,000		
Scanning workstations	742,000		
User Workstations	675,000		
Printers	66,000		
Software		1,235,000	1,300,000
Workflow licenses	175,000		
Document management licenses		625,000	
Other	435,000		
Contractor Services		1,300,000	1,720,000
TOTAL		\$4,568,000	\$5,770,000
PTO FTE needed for project			
Information Technology		4	6
Business Area		3	5

-- Describe the estimated range of benefits expected once the system is operational; elements should map to the benefits listed above

The benefits of implementing POWER are estimated to be within the range of \$1.9 to \$3.6 million each year the system is in operation. Estimates of \$0 indicate those benefits that could not be easily quantified. More definitive benefit calculations will be developed as part of the project management plan.

Element	Each Year	
	Low Est.	High Est.
Efficient Processing	400,000	600,000
5 less FTE for quality control	\$150,000	
2 less FTE to maintain system	\$100,000	
Greater Accountability	0	0
Increased Compatibility with WIPO	1,500,000	3,000,000
Reduction in cost of materials and staff for paper copies		
Material	\$100,000	
Staff	\$700,000	
Improved Work Environment	0	0
TOTAL	\$1,900,000	\$3,600,000

Other Issues or Considerations Impacting the Decision

-- Describe any known budget, regulatory, security, or legal constraints specific to the business process

- The implementation of this system depends on the ratification of the Trademark Law Treaty
- The Department of State, consulting with experts from PTO, is working hard to resolve the issues that prevent the United States from acceding to the Madrid Protocol.

APPENDIX C

COST ELEMENTS

Investment Costs

One-time costs associated with the acquisition of information technology equipment and COTS software; non-recurring services; training, start-up and other development contractor or personnel costs, non-recurring infrastructure and other one-time investment costs. Investment costs may be spread out over several years, beginning with the year of inception and concluding with the year the system is declared operational. Investment cost categories include:

Personnel Costs. This category includes personnel costs, employee benefits, and other personnel related costs required for the development of the AIS. This also includes personnel whose work is not in direct support, but who are necessary, such as contract management, training, and security personnel, if applicable.

PTO personnel costs are based on current annual salaries as defined by the General Schedule and Wage Board pay-rates. Where specific skills can be identified with a process or task, the actual grade and step should be used in computing resources. There are a number of ways to estimate contractor labor costs, depending on the technical architecture, interfaces, and software requirements of the AIS. There are various cost estimating models commercially available which can be used to assist in estimating costs for contractor development support. Contact the Office of budget to obtain PTO personnel salary and fringe benefits rates. Contact the CIO Office of Acquisition Management to obtain contractor labor rates.

Other development personnel related costs, which pertain to the performance of the function under consideration, should be included in the analysis, e.g., travel and per diem costs.

Information Technology Infrastructure. The cost of equipment acquired to support the AIS, e.g., input, display, storage, and output hardware. If equipment is leased or leased-to-purchase, this must be reported.

COTS Software. The cost of software purchased to support the AIS. Do not include in-house development costs or contractor software development costs reported elsewhere.

Training. Training costs include the cost of formal training, including instructor or classroom support, and the cost of preparation of training materials or courses.

Other Contracted Services. Cost of contracted telecommunications and consulting services. Telecommunications costs include network services, associated telecommunications line charges, and channel lease, if applicable.

Operations Costs. Recurring costs associated with maintaining the automated information system in a production environment. Operations cost categories include:

Personnel Costs. This category includes operations personnel costs and employee benefits. In-house personnel costs are based on current annual salaries as defined by the General Schedule and Wage Board pay-rates. Where specific skills can be identified with an operation or task, the actual grade and step should be used in computing resources.

Information Technology Infrastructure Operations and Maintenance. Costs, other than labor, required to operate and maintain the AIS during production phase. Also, included are costs for end-user support services, such as help desk support, and operations and maintenance training costs. These costs include:

1. equipment maintenance
2. computer and network operations
3. materials and supplies
4. utilities
5. communications
6. software license fees
7. application software maintenance and modification
8. direct costs for facility operations and maintenance, if applicable

Overhead Costs. Some costs are classified as overhead because it is impossible to associate them directly with products worked on. Included in this category are: accounting, legal, fire protection, custodial services, and general administrative expenses, if applicable.

Economic Analysis
Technical Guideline IT-212.3-10

10/5/1999

APPENDIX D
Sheet1

APPENDIX D SAMPLE COST BREAKOUT ALTERNATIVE _____
(\$thousand)

COST CATEGORY	NO.	UNIT COST	YR 1	YR 2	YR 3	YR 4	YR 5	Sys. Total
INVESTMENT								
Development Contractor Support								
Receipt and Preliminary Processing			100					
Data Conversion			200					
Verification and Validation			100					
SUBTOTAL			400					

**								

Hardware Acquisition								
Main Processor (s)	1	100	100					
Disk Storage	500	1	100	100	100	100	100	
Workflow Server	1	20	20					
Image Duplex Scanner	1	21	21					
Printer	5	5	5	5	5	5	5	
SUBTOTAL			246					

**								

Software Acquisition								
Server Software	50	2	100					
SUBTOTAL			100					

**								

Training (formal)								
Programmer/Analyst	10	2	4	4	4	4	4	
User	20	2	8	8	8	8	8	
SUBTOTAL			12					

**								

OPERATIONS/MAINTENANCE								
Hardware				5	5	5	5	

Economic Analysis
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10/5/1999

Application Software				35	35	35	35	
Workflow License	150	1	150					
Upgrade Software Training				5	5	5	5	
SUBTOTAL			150	45	45	45	45	

**								

TOTAL UNDISCOUNTED COST (constant \$)			908	162	162	162	162	1,556

APPENDDD cost sheet

Sheet2

APPENDIX D SAMPLE COST BREAKOUT ALTERNATIVE _____
(\$thousand)

COST CATEGORY	YR 1	YR 2	YR 3	YR 4	YR 5	Sys. Total
DISCOUNTED PRES. VALUE	817	146	146	146	146	
NET PRES. VALUE						1,401

APPENDDD cost sheet

APPENDIX E

BENEFIT ELEMENTS

The following is a list and description of benefit indicators. Benefits should be stated in terms of improved effectiveness, service, productivity, efficiency of operations, or reduced costs. Annotations in smaller typeface provide an example of the type of information that can be found within these elements, and are for illustrative purposes.

Quantifiable Benefits

Improved Operating Efficiency. At what rate does the system consume resources to achieve its output (e.g., copies made per hour or orders per day).

Example: With the implementation of Alternative X, the patent application images will be converted into an electronic form allowing the elimination of current manual processing activities currently performed in OIPE. The automated OIPE processes can be performed in parallel on electronic copies of the patent application, reducing processing time, and operational costs.

- All patent applications will be automatically screened for National Security Interests.
- Ninety percent of all patent applications will be correctly classified to the Art Unit level and automatically routed to the appropriate sector of the Examiner Corps. This will directly support the PTO's goal of moving to examining groups within Technology Centers.
- The implementation of automated initial classification for routing will reduce the number of Transfer Inquiries associated with current manual initial routing by 50 percent beginning in FY 2000.
- All patent applications received will provide immediate electronic mail and/or facsimile notification to the applicant when it is correctly processed by PACE.

Increased Reliability. This describes the system in terms of its probable failure rate.

Example: The electronic representation of the patent application captured by Alternative X will be stored on magnetic storage and backed up on magnetic tape, providing redundancy for the paper patent application. The magnetic tape backup will be stored off-site, providing even greater backup and recovery assurance. This will reduce non-productive time due to the need to search, retrieve, and copy paper applications by 50 percent beginning in Year 2.

Increased Accuracy. What is the error rate? It may be possible to measure errors per operating time period, the number of errors per document scanned, errors per hundred records, errors per 100 items produced, etc.

Example: The text of all patent applications will be captured with at least 95 percent accuracy.

Increased Productivity. (Related to staffing) Number of items per productive staff hour, volume of output related to staff hours.

Example: With the implementation of Alternative X, the PTO's Office of Human Resources will reduce to one day from date of receipt, the time necessary to rate, panel and select an applicant. This will be exclusive of Supervisory Patent Examiner review. Ninety-five percent of all applications will be available for re-scoring by a SPE within 1 hour after the final item of supporting documentation is scanned and indexed at the PTO scanning station.

Reduced Costs.

Example: Assuming that the bibliographic data format is used by 35 percent of applicants in January 1999 and rises to 50 percent by the end of FY 1999, savings will begin to be realized in FY 2000 in the following areas: (a) reduced overtime used to correct filing fees, approximately \$60,000 per year, and (2) redistribution of 18 FTE used to perform initial key entry from pre-examination to examination in FY 2000.

System Effectiveness. How well do the functional and technical capabilities of the alternative satisfy the high level technical architecture requirements?

Example: Alternative X will provide the text of a patent application, which requires significantly less storage than the images for the patent application's pages. Systems that require only the text of the application will benefit from the retrieval and processing of a smaller block of data.

Intangible Benefits

Where quantifiable measures cannot be easily linked to an outcome, benefits can be stated in qualitative terms, for example:

Improved Customer Service. Identify how development and deployment of the AIS will improve customer satisfaction, meet customer needs, or improve delivery of services.

Example: Alternative X will automatically notify applicants via Internet electronic mail and facsimile that their information has been received and a filing date assigned. This process currently takes weeks after the receipt of a patent application. Increased customer satisfaction will occur as they receive more timely and accurate information.

Improved Work Environment. Identify how the quality of work life, morale, safety or security of the work environment will be improved.

Example: The physical surroundings that PCT staff works in will be improved as stacks of papers are eliminated from desks and floors. The space currently occupied by paper could be returned to staff. The work area would be cleaner, less cluttered, more open, and generally more esthetically pleasing.

Compatibility. Describes how well an alternative's functional and technical requirements will interrelate with future PTO systems.

Example: Alternative X will begin to lay the foundation for processing of patent applications into intelligent documents that will support on-line examination systems as well as automated publication systems.

APPENDIX F

ECONOMIC ANALYSIS REPORT
TABLE OF CONTENTS

- i. Executive Summary
- ii. Table of Contents

1. Introduction

- 1.1 Purpose
- 1.2 Background
- 1.3 Objective(s)

2. Assumptions and Constraints

3. Cost and Benefit Analyses

- 3.1 Alternatives Considered
 - 3.1.1 Current System
 - 3.1.2 Proposed Alternatives
- 3.2 System Life
- 3.3 Cost Categories and Estimates
- 3.4 Benefit Categories and Measures

4. Sensitivity Analysis

5. Conclusions and Recommendation

- 5.1 Conclusions
- 5.2 Recommendation

Appendix A References

Appendix B Glossary of Terms and Acronyms

APPENDIX G

ECONOMIC ANALYSIS REPORT FORMAT AND CONTENT

Annotations in smaller typeface provide an example of the type of information to be included in each section. **In all examples, the number of alternatives, computations, and their relationships are for illustrative purposes only.**

- i. Executive Summary
- ii. Table of Contents

Section 1. Introduction

Content: Statement of the business environment, the business goals and objectives and how they support PTO's mission, expected business benefits occurring as a result of development, deployment or enhancement of the automated information system, and why there is a need to evaluate different alternatives to meeting the goals of the business area and PTO's mission. Principal stakeholders involved in the analysis should also be identified. (See Section 1.3 of the TSG)

1.1 Purpose

Example: The Job Application Rating System will provide internal controls and streamline labor intensive personnel processes in a timely manner. This will enable the PTO to:

- (1) Recruit quality applicants over the Internet
- (2) Rate employment applications accurately
- (3) Improve the speed of the hiring process
- (4) Reduce the paper flow now present in the hiring process

1.2 Background

Example: The Office of Personnel Management (OPM) has been providing hiring assistance to the PTO by means of an electronic employment application system (MARS). The demand for Human Resource recruitment services has been increased in recent years but the services provided by OPM have failed to meet the PTO's requirements for timely hiring support. Additionally, OPM service is not cost effective. The PTO has the requirements to hire 550 new examiners during FY 1998, with similar numbers anticipated for succeeding years.

1.3 Objectives(s)

Example: JARS enables the PTO to carry out its mission by providing an integrated approach to human resource management and support for business process improvements. Business objectives include:

- Reduced overall time from the initiation of a request for employment to completion of a re-scored listing
- Elimination of paneling costs paid to another agency
- Near instantaneous return of certificates
- Automated protection of veterans' hiring preferences

Section 2. Assumptions and Constraints

Content: All assumptions, constraints, and conditions that framed the cost and benefit analyses must be identified and documented. (See Section 2.2 of the TSG)

Example:

- Feasible alternatives must be capable of electronically performing or supporting all functions currently supported by the Office of Personnel Management (OPM).
- Feasible alternatives must adhere to all applicable OPM regulations for screening, processing, recruiting, hiring, and staffing actions.
- Feasible alternatives must adhere to all requirements for the privacy and confidentiality of applicant information.
- Feasible alternatives must be capable of accepting up to xyz, (abc page) applications per day.
- Feasible alternatives must be able to accept applications on-line via the PTO Web Page over the Internet.
- Feasible alternatives must allow for full transfer and retrieval of documents (in both text and image formats) to and among all end users.
- Feasible alternatives must be capable of initially maintaining from 2,000 to 10,000 qualified applicant records without the need to increase current server storage capacity.

- The growth in Trademark applications has continued to exceed prior year projections. PTO assumes that the annual average growth rate of 11 percent will continue throughout the system life.

Section 3. Cost and Benefit Analyses

Content: Describe all alternatives considered. Alternatives that were originally considered but later shown to be technically or operationally unfeasible need not be quantified or analyzed in depth but should be discussed. If there is a current system, it must be included. (See Section 2.3 of the TSG)

3.1 Alternatives

Example: The three alternatives considered for PGPub were the current system, which is a paper-based system, and two variations of automated alternatives.

3.1.1 Current System

Example: The paper-based alternative consists of physical handling of patent applications through each step of the patent examination process, through issuance and publication of the patent.

3.1.2 Proposed Alternatives

Example: The two automated alternatives considered were:

1. APS Architecture Alternative - which involves modification of the existing APS subsystems, i.e., Messenger, PALM, CSIR, and GIS in order to satisfy all PG-Pub Requirements, and
2. DMS Architecture Alternative - which involves development of a PGPub System distinct from the existing APS. This system would be based on one or more commercial off-the-shelf (COTS) enterprise document management products.

3.2 System Life

Content: State the period of time over which alternatives will be compared. This will normally be the period of time from project inception through system replacement or retirement. This period is to include the system's operational phase. (See Section 2.4 of the TSG)

Example: JARS investment and operational costs are presented for a five-year period, addressing the following areas:

- Hardware and software costs for the host JARS server.
- Hardware and software costs for the Workflow/Image Components.
- Contractor costs associated with developing and maintaining the JARS system.

3.3 Cost Categories and Estimates

Content: Identify the investment and operations cost categories and associated costs for each, including the sequence of steps taken to complete the analyses. Estimates should be made by the year the cost is to be incurred. Computations, tables, and mathematical calculations used to derive cost estimates should be provided as appendices to the Economic Analysis Report, which should include computations using current dollars (treated for inflation). Identify the inflation rate used (See Section 2.5 of the Economic Analysis Technical Standard and Guideline, IT-212.3-10).

A sample layout of how summary costs may be broken out, by year incurred, follows. Cost estimates are for illustrative purposes.

Example: The proposed costs of hardware, software, and contractor development for Alternative 1 are as follows:

	ALTERNATIVE 1 SUMMARY COSTS In thousands (\$)					
	FY1998	FY1999	FY2000	FY2001	FY2002	TOTAL
Operational						
HW Server Maintenance		5	5	5	5	20
Maintenance Contractor Support		35	35	35	35	140
Sub-total		40	40	40	40	160
Investment						
JARS HP Server	100					100
Open/Workflow Licenses (150 users)	165					165
Open/Workflow Server (5 PCs)	20					20
Image Duplex Scanner	21					21
Development Contractor Support	400					400
External Development Consultants	65					65
Sub-total	771					771
TOTAL	771	40	40	40	40	931

Example: The proposed costs of hardware, software, and contractor development for Alternative 2 are as follows:

	ALTERNATIVE 2 SUMMARY COSTS In thousands (\$)					
	FY1998	FY1999	FY2000	FY2001	FY2002	TOTAL
Operational						
HW Server Maintenance		10	10	10	10	40
Maintenance Contractor Support		50	50	50	50	200
Sub-total		60	60	60	60	240
Investment						
JARS HP Server	100					100
Open/Workflow Licenses (150 users)	165					165
Open/Workflow Server (5 PCs)	20					20
Image Duplex Scanner	21					21
Development Contractor Support	600					600
External Development Consultants	85					85
Sub-total	991					991
TOTAL	991	60	60	60	60	1231

3.4 Benefit Categories and Measures

Content: Identify the benefits expected from deploying the feasible alternative. Benefits should be stated in terms of improved effectiveness, productivity, performance, or customer service and satisfaction. Identify information and data sources, the measurement scheme used, and a description of any intangible benefits. Computations, tables, and mathematical calculations used to derive quantifiable benefit estimates should be provided as appendices to the Economic Analysis Report (See Section 2.6 of the Economic Analysis TSG, IT-212-3-10).

ALTERNATIVE 1

Example: Quantifiable Benefits of Alternative 1 include:

Productivity: With the implementation of Alternative 1, the PTO's Office of Human Resources will reduce to one day from date of receipt, the time necessary to rate, panel and select an applicant. This will be exclusive of Supervisory Patent Examiner review.

- Ninety-five percent of all applications will be available for re-scoring by a SPE within 1 hour after the final item of supporting documentation is scanned and indexed at the PTO scanning station.
- Ninety-five percent of all complete applications will be available for inclusion in an electronically generated certificate within one hour after it is re-scored.
- The required personnel action forms will be produced and will be generated automatically within 1 minute after being requested.

Using the average hourly rate for personnel participating in pre and post-scoring activities, which is Grade GS-7, Step 5 at \$35.12, the value of saved resources associated with these benefits is estimated to be 2,000 saved hours per year, or \$70,240 per year.

Reliability: Tracking record of applications, SF-50s, SF-52s, SF-182s, and resumes will be improved. Since these forms will be scanned and linked to the application record stored in a relational database, the system will allow PTO to create a better audit trail and improve internal controls. This would eliminate mishandled paperwork.

- Misdirected or lost applications, resumes, and other personnel action forms will be reduced by 10 percent in the base year, and by an additional 10% for Years 2-5.

Using the average hourly rate for personnel required to locate misdirected or lost records, which is Grade GS-7, Step 5 at \$35.12, the value of saved resources associated with these benefits is estimated to be 100 saved hours for the base year, or \$3,512. This will increase by 10% for Years 2-5.

Accuracy: Direct scanning of applications and other forms will eliminate the necessity to manually key application data.

- This will create better than a 99% accuracy rate.

With the initiation of direct scanning of applications and other forms, there would be no need for a contractor to continue to manually key application data. This would result in a direct dollar savings of \$500,000 for Years 2-5.

Reduced Storage and Space Requirements:

- Automated workflow will create a paperless electronic environment.
- Since application data will be received, accessed, retrieved, and shared electronically, the requirement for additional filing cabinets and other paper-bound means of storage will be eliminated beginning in Year 2.
- No additional computer or network resource or capacity requirements will be required by Alternative 1.

The average cost of filing cabinets, which offer a paper copy storage capacity equivalent to the same number of electronic records, is \$2,500 per unit. A direct dollar savings of \$125,000 is estimated over Years 2-5. Using the average of 34.75 square feet per unit, at the current monthly floor space cost of \$28/square foot, avoiding the purchase of additional filing cabinets is estimated to save \$48,650 in rental space costs over Years 2-5.

Reduced Costs: Operations and maintenance costs will be reduced to \$40,000 for each year of the system life cycle, beginning in Year 2. This is a reduction of \$25,000 for Years 2-5.

Example: Qualitative Benefits of Alternative 1 include:

Responsiveness to Customers:

- The capability to automatically notify applicants, via the Internet electronic mail and facsimile, that the application has been received along with the date of receipt.
- Improved management reporting and time management.
- Increased customer satisfaction will occur as they receive more timely and accurate information.

	ALTERNATIVE 1 SUMMARY OF QUANTIFIABLE BENEFITS In thousands (\$)				
	FY1998	FY1999	FY2000	FY2001	FY2002
Saved Resources					
Productivity	70	70	70	70	70
Reduction of Lost/Misdirected Records	3	3	4	4	4
Direct Scanning of Applications		500	500	500	500
Reduced Storage Requirements		31	31	31	31
Reduced Space Requirements		12	12	12	12
Lower Operations/Maintenance Costs		25	25	25	25
TOTAL	73	641	642	642	642

ALTERNATIVE 2

Example: Quantifiable Benefits of Alternative 2 include:

Productivity: With the implementation of Alternative 2, the PTO's Office of Human Resources will reduce to one day, from date of receipt, the time necessary to rate, panel and select an applicant. This will be exclusive of Supervisory Patent Examiner review.

- Ninety-five percent of all applications will be available for re-scoring by a SPE within 1 hour after the final item of supporting documentation is scanned and indexed at the PTO scanning station.
- Ninety-five percent of all complete applications will be available for inclusion in an electronically generated certificate within one hour after it is re-scored.
- The required personnel action forms will be produced and will be generated automatically within 1 minute after being requested.

Using the average hourly rate for personnel participating in pre and post-scoring activities, which is Grade GS-7, Step 5 at \$35.12, the value of saved resources associated with these benefits is estimated to be 2,000 saved hours per year, or \$70,240 per year.

Reliability: Tracking record of applications, SF-50s, SF-52s, SF-182s, and resumes will be improved. Since these forms will be scanned and linked to the application record stored in a relational database, the system will allow PTO to create a better audit trail and improve internal controls. This would eliminate mishandled paperwork.

- Misdirected or lost applications, resumes, and other personnel action forms will be reduced by 10 percent in the base year, and by an additional 10% for Years 2-5.

Using the average hourly rate for personnel required to locate misdirected or lost records, which is Grade GS-7, Step 5 at \$35.12, the value of saved resources associated with these benefits is estimated to be 100 saved hours for the base year, or \$3,512. This will increase by 10% for Years 2-5.

Accuracy: Direct scanning of applications and other forms will eliminate the necessity to manually key application data.

- This will create better than a 99% accuracy rate.

With the initiation of direct scanning of applications and other forms, there would be no need for a contractor to continue to manually key application data. This would result in a direct dollar savings of \$500,000 for Years 2-5.

Reduced Storage and Space Requirements: Automated workflow will create a paperless electronic environment.

- Since application data will be received, accessed, retrieved, and shared electronically, the requirement for additional filing cabinets and other paper-bound means of storage will be eliminated beginning in Year 2.
- No additional computer or network resource or capacity requirements will be required by Alternative 2.

The average cost of filing cabinets, which offer a paper copy storage capacity equivalent to the same number of electronic records, is \$2,500 per unit. A direct dollar savings of \$125,000 is estimated over Years 2-5. Using the average of 34.75 square feet per unit, at the current monthly floor space cost of \$28/square foot, avoiding the purchase of additional filing cabinets is estimated to save \$48,650 in rental space costs over Years 2-5.

Reduced Costs: Operations and maintenance costs will be reduced to \$60,000 for each year of the system life cycle, beginning in Year 2. This is a reduction of \$5,000 for Years 2-5.

System Effectiveness: Alternative 2 will support future expansion efforts within the technical environment, using data formats, protocols, standards and products specified in the PTO Technical Reference Model.

- Alternative 2 will support record growth to 15,000, with the capability to purge records older than 6 months.
- Alternative 2 is compatible with future plans for structured processing of other hiring scenarios (contact interviews or mailed resumes or applications).

Example: Qualitative Benefits of Alternative 2 include:

Responsiveness to Customers:

- The capability to automatically notify applicants, via the Internet electronic mail and facsimile, that the application has been received along with the date of receipt.
- Improved management reporting and time management.
- Increased customer satisfaction will occur as they receive more timely and accurate information.

	ALTERNATIVE 2 SUMMARY OF QUANTIFIABLE BENEFITS In thousands (\$)				
	FY1998	FY1999	FY2000	FY2001	FY2002
Saved Resources					
Productivity	70	70	70	70	70
Reduction of Lost/Misdirected Records	3	3	4	4	4
Direct Scanning of Applications		500	500	500	500
Reduced Storage Requirements		31	31	31	31
Reduced Space Requirements		12	12	12	12
Lower Operations/Maintenance Costs		5	5	5	5
TOTAL	73	621	622	622	622

Section 4. Sensitivity Analysis

Content: If a sensitivity analysis was completed, the parameter or assumption selected for the analysis must be identified and the impact of any expected change must be documented. (See Section 2.8 of the TSG)

Example: The analysis of costs and benefits for each alternative was completed with several assumptions made regarding the number of dial-up system users, and the average labor rate for all users. Changing these variables had the following impact on the results of the analysis.

Changing the Number of Participants

The cost of providing access to the system to 100 users is \$52,382 in investment costs, and \$100,000 in operations and maintenance costs over the five-year system life. If the number of users is changed to 900 additional users, the cost per additional user will be the user kit at a cost of \$265.93, plus a prorated share of the \$52,382, for a total user cost of \$324.13. Using the average hourly salary rate of \$34.41, repayment time is 9.42 work hours per employee. If participation increases to 2,400 additional users, cost per user will drop to \$287.76, repaid within 8.36 work hours per employee.

Changing the Value of Resources

Direct dollar value of benefits were calculated using average labor rates for all PTO employees. The median grade level for all PTO employees is Grade 10, Step 5, which equates to a labor rate of \$19.01, or \$26.61, assuming 40% fringe benefits. Using this value, the repayment period would be 14 months. However, if the assumption is made that lower graded employees would not utilize the remote dial-up system because they are less directly involved in critical decision making, the labor rate parameter changes to the average hourly labor rate for personnel GS-7 and above, which is \$35.12 or \$48.16 with benefits. The repayment period then drops to 7 months.

Section 5. Conclusions and Recommendation

5.1 Conclusions

Content: This is where the results of the comparison and ranking of alternatives are presented. Include the evaluation technique selected and why, and the major grouping used for ranking. (See Section 2.7 of the TSG)

Example 1: Two JARS feasible alternatives were considered within the scope of this analysis. Both of these alternatives offered automated solutions to achieve the stated business objectives and PTO's mission. Following the guideline for cost comparison of alternatives contained in the Technical Standard and Guideline for Economic Analysis, IT-212.2-13, the Net Present Value technique was used.

Both alternatives were determined to be technologically feasible and capable of operating within the existing PTO information technology infrastructure, with no additional or new computer or network resource or capacity requirements. Operational and investment cost categories for both alternatives were identical. Base year investment cost estimates for both alternatives were identical, with the exception of contractor development costs, which were slightly higher for Alternative 2. Operations and maintenance cost estimates for years 2-5 were also higher for Alternative 2.

Both alternatives offer quantifiable benefits within identical benefit categories. Labor-intensive activities are streamlined and the time necessary to rate, panel and select qualified examiner applicants is reduced to 1 day for 95 percent of all applications under both alternatives. Misdirected or lost application forms will be reduced by identical rates (10%) in the base year, as well as Years 2-5 (10% each year) for both alternatives. Accuracy of application information is assessed at 99% for both alternatives. Quantifiable benefit assessments are provided in Section 3 of the Economics Analysis Report, supported by mathematical computations and spreadsheets provided as appendices to the report.

Alternative 2 offers added expansion capabilities for record growth and other hiring scenarios that are not offered by Alternative 1.

Both alternatives offer similar intangible benefits of improved customer satisfaction and delivery of timely information to PTO supervisors and managers.

Changing assumptions and parameters resulted in a relatively insensitive change in the results of the analysis of each alternative. Varying the participation rate or the labor rate caused the system repayment period to vary between 7 and 14 months. The maximum repayment period would be 14 months.

Example 2: Based on the results of the economic analysis, it was determined that the life cycle costs for Alternative 1 are greater than for Alternative 2. The majority of these increased costs is represented by greater maintenance costs for Years 3-5. However, it was also determined that quantifiable benefits for Alternative 2 are greater than for Alternative 1. Quantifiable benefit assessments are provided in Section 3 of the Economics Analysis Report, supported by mathematical computations and spreadsheets provided as appendices to the report.

In terms of increased productivity, the new storage units proposed in Alternative 2 offer faster access times due to greater electronic storage capability, which means that replacement of paper search files with electronic files as the basic medium will be achieved faster. This benefit is computed to save the PTO \$2.0 million in paper storage costs by Year 3.

Alternative 2 offers storage units which occupy one-third the floor space of the storage units offered in Alternative 1 (12.25 square feet each as opposed to 34.75 square feet). At a floor space cost of \$28 per square foot, replacing the existing units with those included in Alternative 2 represents a cost avoidance of \$8,820 per month over Alternative 1.

Quantifiable benefit assessments for both alternatives are provided in Section 3 of the Economics Analysis Report, supported by mathematical computations and spreadsheets provided as appendices to the report.

Example 3: The results of the economic analysis show that the present value of costs and benefits for the three alternatives are unequal. The bottom to top ranking order of each alternative is:

Alternative #	System Life	Present Value at 10%
1	5 Years	\$107,972,000
2	5 Years	\$182,075,000
3	5 Years	\$249,000.000

Present value computations are provided in Section 3 of the Economics Analysis Report, supported by mathematical computations and spreadsheets provided as appendices to the report.

5.2 Recommendation

Content: The recommended alternative should be identified. If additional funding analysis or an acquisition plan are required, it should be stated here.

Example 1: Based on the results of the economic analysis, it was determined that quantifiable and qualitative benefits for both alternatives are equal and that the added benefit of potential expansion offered by Alternative 2 did not outweigh the lower costs offered by Alternative 1 because the system life would likely preclude the implementation of these potential hiring scenarios.

- Based upon the least cost category, Alternative 1 is recommended.

Example 2: The stated objectives of the economic analysis, as well as the goals of the business area and PTO's mission, warrant recommendation of Alternative 2, based upon its maximum quantifiable benefits over those of Alternative 1.

Example 3: Based upon the highest present value ranking of all alternatives, Alternative 3 is recommended.

- Appendix A References
- Appendix B Glossary